VIRGINIA GIS REFERENCE BOOK

General Application Category/Sub Application Name: Public Works/Service Authority – Facilities Mapping

Product /Service/Function Name: Environmental Impact Analysis

P/S/F/ Description: An application used by Public Works and Service Authority decision makers to assess the impacts of projects and environmental alterations that pose risks to the residents in affected areas.

Product /Service/Function

1. Spatial Data

Spatial Data Definition: (ESRI, GIS Glossary, 1996) Information about the location and shape of, and relationships among geographic features, usually stored as coordinates and topology. In general terms, spatial data is geographic information.

Minimum Requirements:

FRAMEWORK BASE MAP

A digital base map is required, covering the entire facility service area, including identifiable roads, hydrology, and other basic framework data layers. The basic recommendation for a base map format is vector; however, a raster base map, such as a scanned, georeferenced facility map, may suffice. High-resolution digital orthophotography, or maps generated from these data will provide the most accurate base map and should include many features visible from the air at a specific altitude.

UTILITY SERVICE AREAS

Digital maps of water and sewer service areas in vector polygon format.

UTILITY PIPES

Digital maps of water and sewer pipes in vector line format.

STORMWATER DRAINAGE SYSTEM

Digital stormwater drainage system features including:

- Inlets
- Outlets
- Manholes
- Pump Stations

WETLANDS

The National Wetlands Inventory maps downloadable from the NWI FTP site, by County. These data are mapped at 1:12000 scale, and can be downloaded in Digital Line Graph (DLG) format. Tools may also be downloaded from this site to convert the DLG files to ArcINFO (Export) file format.

SOILS

The NRCS soils maps can be obtained from the NCRS Virginia Office, at the following address:

State Conservationist
Culpeper Building, Suite 209
1606 Santa Rosa Road
Richmond, VA 23229-5014
Phone: 804-287-1687

General Soil Data for GIS (STATSGO) and Detailed Soil Data for GIS (SSURGO) is available in the following GIS formats:

ARC Coverage-Windows
ARC Coverage-UNIX
DLG-3 – Optional
and Grass-Vector

DEMOGRAPHICS

Digital Census 2000 information can be downloaded from the U.S. Census Bureau.

LAND USE

United States Geological Survey Land Use Land Cover Information may be utilized; but specific information collected and developed by the Facility may be more accurate.

ENVIRONMENTAL CONCERNS

Vector point locations or vector polygon areas denoting environmental concerns should be included. These data may be NPDES permit point locations, Bald Eagle nesting site point locations, Chesapeake Bay protection areas, or other areas of environmental significance.

Optional Requirements: Optional spatial data requirements for this application include:

1.) The use of a more accurate base map, from a source such as aerial photography, surveys, GPS or digital orthophotos.

2. Attribute Data

Attribute Data Definition: (ESRI, GIS Glossary, 1996) 1.) A characteristic of a geographic feature described by numbers, characters, images and CAD drawings, typically stored in a tabular format and linked to the feature by a user-assigned identifier.

Minimum Requirements:

UTILITY SERVICE AREAS

An attribute table for each service area polygon should be developed, noting the specific service area name or other unique identifier.

UTILITY PIPES

If the developer is denoting the diameter of the pipe by layer or color, no attributes are required. However, for more sophisticated analysis capabilities, it is recommended that the coverage's attribute table houses the diameter or size of each line.

STORMWATER DRAINAGE SYSTEM

Stormwater System Pipes

No attribution is required. Simple line work showing each pipe's location is considered a bare minimum. However minor attribution is suggested, and may include a pipe identifier and a pipe diameter. The collection system a pipe is within may also be attributed to the line.

Stormwater Collection System

A unique name or number should be assigned to each collection system polygon.

Stormwater System Inlets

A unique name or number should be assigned to each system inlet point feature. The collection system an inlet is within may also be attributed to the point feature.

Stormwater System Manholes

The unique name or number should be assigned to each system manhole point feature. The collection system a manhole is within may also be attributed to the point feature.

Stormwater System Outlets

The unique name or number should be assigned to each system outet point feature. The collection system an outlet is within may also be attributed to the point feature. An attribute referring to an outlet's designed and estimated flow (in gallons per minute) may also be assigned to the point feature.

Stormwater System Pump Stations

The unique name or number should be assigned to each system pump station feature. An attribute listing the pump station as active or inactive may be associated with each point or polygon feature. The current capacity of the pump station should be included as an attribute, listing the designed and estimated flow in gallons per minute.

WETLANDS

The minimum attribute requirements include those delivered with the NWI spatial data. The NWI attribute table includes the following Wetlands or Deepwater Habitats classification structure:

System:	Marine, Estuarine, Riverine, Lacustrine, etc.
Subsystem:	Subtidal, Lower Perennial, Intermittent, etc.
Class:	Streambed, Rock Bottom, Emergent, Reef, etc.
Subclass:	Organic, Algal, Bedrock, Rubble, sand, etc.

This classification system includes a specific nomenclature for each wetland polygon. For example, the code, E2RF, refers to the following wetland area:

Estuarine, Intertidal, Reef.

SOILS

The minimum attribute requirements include those delivered with the NCRS spatial data.

DEMOGRAPHICS

The minimum attribute requirements include those delivered with the U.S. Census Bureau Data

LAND USE

The minimum attribute requirements include land use/land cover classifications defined by the United States Geological Survey.

Optional Requirements: Many other ancillary tables can be joined to each feature's attribute table for more sophisticated Environmental Impact Analysis. Each Public Works department and Service Authority may wish to integrate other data, as is deemed useful to their specific workflow.

3. Data Acquisition Options (integrated with VBMP digital orthos)

The integration of these data with the VMBP digital orthophotographs may provide better positional reference of system features than as provided in the existing facility base map.

4. Data Conflation Options (integrated with VBMP digital orthos)

Conflation is the method whereby a geographic feature is adjusted to fit a more accurate base map. This process can occur in variety of ways, with the least sophisticated being a "best-fit" methodology. The best-fit method is a visual inspection or comparison of a geographic feature's current position to where it is or should be located on the more accurate base map.

Another conflation option includes rubber sheeting, a method using control points or existing boundaries to establish the new geographic position of a feature.
Finally, the most accurate method of conflating data includes the use of Global Positioning Satellite technology (GPS), or traditional survey instruments to accurately locate each desired object's physical location.

5. GUI / Programming Options

Graphical User Interface Definition: (ESRI, GIS Glossary, 1996) A graphical method of controlling how a user interacts with a computer to perform various tasks. Instead of issuing commands at a prompt, the user performs desired tasks by using a mouse to choose from `a dashboard' of options presented on the display screen. These are in the form of pictorial buttons (icons) and lists. Some GUI tools are dynamic and the user must manipulate a graphical object on the screen to invoke a function; for example, moving a slider bar to set a parameter value (e.g., setting the scale of a map).

GIS software can be modified utilizing a variety of programming languages or scripting languages and may vary depending upon the system architecture. Languages such as

Microsoft Visual Basic are commonly used to invoke macros and customized functions such as GIS queries. Commonly used languages include: Visual Basic, C++, Java, HTML, ASP, ColdFusion, JSP, PERL, PHP and CGI.

6. Internet Functionality and Options

Internet functionality should include basic GIS functions available in a thin client GIS application, such as ESRI's ArcExplorer (i.e. Zoom In, Zoom Out, Pan, Identify, Query, Thematic Mapping … etc.). Additional functionality may include appropriate hyperlinks to critical and related information on the Internet related to certain queries or operations within the application. A dedicated "needs based" approach to determine user interface options and functionality is highly recommended before actual application work is to begin.

An Internet application allows the organization to share its spatial and tabular information to all authorized users via a familiar Internet Browser interface. This eliminates multiple software license fees. Additionally, the Map Server (Web Server) is the only GIS hardware/software component that would be managed by the localities Information Technology Department.

7. Minimum Technical Requirements

A Basic working knowledge of a leading GIS software, and Internet Browser are required. A Pentium III or greater CPU, with a minimum of 128MB Ram, 16MB Video Card, is required. A higher speed Internet connection is recommended for GIS Internet application deployment and analysis. Most leading GIS software is customizable using MS Visual Basic or other common language. It is suggested that the developer have a working knowledge of (at least) Visual Basic before attempting GUI development.

Optimum Technical Requirements:

In the case where a local government employs a highly capable Information Technology Department, other languages may be considered, such as JSP, Java, Visual Basic, ASP, and Cold Fusion. In most cases, these languages are related to Internet application development. A web developer with three years of experience should be able to customize and/or develop a unique Internet Map Server application.

8. Administrative / Management Requirements

Management concerns will involve technical support, system maintenance and, of course, human resource management issues of a technical product. These issues are minimized if the maintenance and/or hosting of the application are contracted to a GIS application development and hosting organization. Technical and administrative issues become more critical and consuming when developing and/or hosting an application in-house. General expertise in GIS is suggested if outsourcing application development and hosting. In-house application development and hosting will require GIS specialist human resources,

advanced web programming human resources, and significant technical material resources (hardware/software).

9. Cost – Cost/Benefit

The cost of developing a Environmental Impact Analysis application (in house) should cost less than $25,000 depending upon the availability and condition of existing facility data and the needs of the Authority or Public Works department. 10% of this cost is attributed to the acquisition of the facility data. Programming the application, which includes posting custom queries to the GUI, accounts for the remaining 90%.

10. Standards / Guidelines Summary

The facility features, and any ancillary databases, should reflect changes or modifications as soon as realistically possible.

11. Startup Procedures/Steps

Application Outline / Blueprint: Application purpose, interface design, functionality, queries and "look and feel" should be determined and documented as an initial step. Stakeholders should be involved in this step.
Data Acquisition: The attribute data may be obtained from internal or external sources, whether in digital or hard copy format, and normalized. The spatial base map and facility data can be obtained or generated internally. Attribute and spatial data that cannot be obtained internally may require field collection and normalization.
Sourcing Determination: Determine entity/entities that will be performing data development functions, application development functions and application hosting functions.

12. Estimated Time Line and/or Implementation (stand alone) schedule

The estimated time to develop this application is three months. The duration is defined by the availability and condition of facility information. Typically a basic application can be developed in under 500 man-hours.

13. Best Practice Examples in Virginia

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